What is claimed is:

1. A coil for transmitting and/or receiving magnetic excitations, comprising a meanderline conductive structure comprising a plurality of conductive segments forming a substantially cylindrical profile and generating a non-vanishing magnetic field distribution in response to current flow through said coil in a substantially annular region surrounding said conductive segments and a substantially vanishing magnetic field distribution in a region outside said annular region.

2. The coil of claim 1, further comprising an input terminal and an output terminal to allow, respectively, ingress and egress of an electrical current into and out of the coil.

3. The coil of claim 1, wherein each conductive segment comprises a pair of elongated conductors separated by a selected distance and a bridging conductor electrically connecting said pair of conductors such that a flow of current from said input terminal to said output terminal results in current in opposite directions in said pair of conductors.

4. The coil of claim 3, wherein a spacing between the conductor pair of each segment is substantially similar to a corresponding spacing between the conductor pair of another segment.

5. The coil of claim 3, wherein separations between conductor pairs of different conductive segments are non-uniform,

6. The coil of claim 3, wherein said annular region has a width commensurate in size with said selected distance between said pair of conductors.

7. The coil of claim 1, wherein the magnetic field generated by the coil at a location within said annular region decreases as a distance of said location from said conductive segments increases.

8. The coil of claim 2, further comprising at least a capacitor electrically coupled to one of said input or output terminals to allow any of tuning the coil to a selected frequency and matching the coil's impedance to impedance of one or more other components coupled to the coil.

9. The coil of claim 3, further comprising a plurality of capacitors each coupled between said two elongated conductors of one of the conductive segments to function as distributed series tuning capacitors.

10. The coil of claim 1, wherein said conductive segments are formed of copper.

11. The coil of claim 1, further comprising a substantially cylindrical conductive shield disposed coaxially within said coil so as to further diminish said substantially vanishing magnetic field.

12. A coil assembly for radiofrequency quadrature operation, comprising

a pair of conductive coils, each comprising

an input terminal,

an output terminal, and

a plurality of conductive segments extending from said input terminal to said output terminal, each of said conductive segments comprising two elongated conductors disposed substantially parallel to one another such that a flow of current from said input terminal to said output terminal results in opposite current directions in said conductors,

wherein said conductive coils are disposed in proximity of one another such that application of two voltage signals having substantially equal amplitudes and about 90

degree phase difference, each across one of said coils, generates a circularly polarized RF magnetic field.

13. The coil assembly of claim 12, wherein said coils are disposed relative to one another such that the conductors of each conductive segment of one coil are substantially perpendicular to the conductors of a corresponding conductive segment of the other coil.

14. The coil assembly of claim 12, wherein said coils are flat.

15. The coil assembly of claim 12, wherein each of said coils has a cylindrical profile.

16 The coil assembly of claim 15, wherein said coils are disposed coaxially relative to one another.

17. The coil assembly of claim 12, further comprising at least two capacitors each electrically coupled to one of said coils for tuning said coil to a selected frequency.

18. The coil assembly of claim 17, wherein said coils are tuned to different frequencies.

19. A coil for transmitting and/or receiving magnetic excitations, comprising a meanderline conductive structure having an input lead and an output lead, said conductive structure comprising a plurality of conductive segments forming a substantially cylindrical profile, each of said conductive segments comprising at least a pair of elongated conductors disposed substantially parallel to one another such that the flow of current from said input lead to said output lead through the coil results in opposite current directions in each conductor of the pair, thereby generating a non-vanishing magnetic field in a substantially annular region surrounding the conductive segments and a substantially vanishing magnetic field outside said annular region.

20. The coil of claim 19, further comprising a plurality of capacitors disposed along said conductive structure for tuning said coil to a selected frequency.

21. A coil for transmitting and/or receiving radiofrequency radiation, comprising a meanderline conductive structure comprising a plurality of conductive segments collectively forming a selected profile, each conductive segment comprising at least two elongated conductors disposed substantially parallel to one another, said conductive structure further comprising an input terminal and an output terminal such that a flow of current from said input terminal to said output terminal will result in opposite current directions in said two elongated conductors of each of said conductive segments.

22. The coil of claim 21, wherein said selected profile corresponds to a sector of a cylinder.

23. The coil of claim 21, wherein said selected profile conforms to at least a portion of an inner surface of a patient's artery.

24. The coil of claim 21, wherein said selected profile corresponds to a curved surface substantially conforming to a patient's anatomical surface.

25. The coil of claim 21, wherein said meanderline conductive structure is substantially rigid.

26. The coil of claim 21, wherein said meanderline conductive structure is substantially flexible.

27. A medical catheter, comprising

a flexible body extending from a proximal end to a distal end,

a coil coupled to said flexible body in proximity of said distal end for generating and detecting magnetic signals, and

an amplifier coupled to said catheter in proximity of said coil and electrically connected thereto in order to amplify said magnetic signals.

28. The medical catheter of claim 27, wherein said coil comprises a meanderline conductive structure having a plurality of conductive segments forming a substantially cylindrical profile, said conductive segments being configured such that the coil generates, in response to a current flow therethrough, a non-vanishing magnetic field in an annular region in proximity of said conductive segments and a substantially vanishing magnetic field in a region outside said annular region.

29. The medical catheter of claim 27, wherein said flexible body is formed of a biocompatible material.

30. The medical catheter of claim 27, wherein said flexible body is sized to allow navigation of the catheter through a patient's artery.

31. The medical catheter of claim 27, further comprising at least one capacitor electrically coupled to said coil for tuning said coil to a selected frequency.

32. The medical catheter of claim 31, further comprising an inductor electrically coupled to said capacitor and said coil for facilitating tuning said coil to said selected frequency.

33. The medical catheter of claim 32, further comprising an elongated conductor extending from the proximal end of the catheter to its distal end for electrical coupling to said coil, said conductor being capable of transmitting excitation signals from an excitation external circuitry to said coil and/or transmitting signals detected by said coil to a detection external circuitry.

34. The medical catheter of claim 33, wherein said excitation external circuitry comprises a signal generator for applying an excitation signal to said coil for exciting a collection of polarized spins of a plaque disposed on an interior wall of a patient's artery in which the coil is inserted.

35. The medical catheter of claim 34, wherein said detection external circuitry comprises a detector for detecting signals generated by said polarized spins in response to said excitation.

36. The medical catheter of claim 27, wherein said amplifier comprises a low noise transistor.

37. The medical catheter of claim 27, wherein said coil and said amplifier are housed within said catheter.

38. The medical catheter of claim 27, further comprising one or more varactor diodes electrically coupled to said coil and housed within said catheter, said varactor diodes allowing continuous tuning of said coil.

39. The medical catheter of claim 38, further comprising a feedback circuit electrically coupled to said varactor diodes and said coil for periodically monitoring tuning of said coil and adjusting voltages applied to said varactor diodes so as to optimize tuning of said coil.

40. The medical catheter of claim 27, wherein said flexible body includes a first portion at said proximal end having a first cross-sectional size suitable for housing said coil and a second portion having a second cross-sectional size suitable for housing said amplifier.

41. The medical catheter of claim 40, wherein said first cross-sectional size is larger than said second cross-sectional size.

42. A method for magnetic resonance imaging and spectroscopy of at least a portion of a plaque disposed on an interior wall of a patient's artery, comprising

disposing a coil having a substantially cylindrical profile formed of a plurality of conductive segments in the artery in proximity of said plaque, said conductive segments being configured such that a current flow through said coil generates a substantially vanishing magnetic field within a region within said cylindrical profile though which blood flows and a non-vanishing magnetic field in an annular region in proximity of said conductive segments extending into at least a portion of said plaque,

applying a static magnetic field to said plaque to polarize selected atomic nuclei of constituents thereof,

applying a time-varying magnetic field in said annular region in order to excite said polarized nuclei, and

utilizing said coil to detect radiation emitted by said excited nuclei.

43. The method of claim 42, wherein said nuclei are protons.

44. The method of claim 42, wherein said selected nuclei are any of phosphorus, carbon, oxygen, or sodium nuclei.

45. The method of claim 42, wherein said time-varying signal applied to excite the nuclei includes a frequency substantially equal to Larmor frequency of said nuclei.

46. A medical catheter, comprising

a flexible body extending from a proximal end to a distal end,

a coil having a substantially tubular conductive structure for generating and/or detecting magnetic signals, said coil being coupled to said flexible body in proximity of said distal end.

47. The medical catheter of claim 46, wherein said coil generates a magnetic field in proximity of said conductive structure in response to a current flow therein, and substantially vanishing magnetic field in a region at least partially enclosed by said conductive structure.

48. A medical catheter, comprising

a flexible body extending from a proximal end to a distal end and sized for navigation through at least a portion of a subject's circulatory system,

at least one elongated conductor extending along at least a portion of said flexible body, said conductor being adapted for generating and/or receiving magnetic signals during one operational mode of said catheter, and

a coil coupled to said flexible body at a distal end thereof, said coil having a generally cylindrical conductive structure adapted for generating and/or receiving magnetic signals within an annular region surrounding said conductive structure during another operational mode of said catheter.

49. The medical catheter of claim 48, further comprising a first external circuitry coupled to said elongated conductor for tuning said conductor for imaging an extended length of a subject's artery.

50. The medical catheter of claim 49, further comprising a second external circuitry coupled to said coil for tuning said coil for imaging biological tissue within said annular region upon placement of said catheter in a subjet's artery.

51. The medical catheter of claim 50, further comprising a switch coupled to said first and second external circuitry for selecting one of said operational modes of said catheter.